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The Future Burden of Adolescent Births in Angola Will Remain Very High: Empirical Evidence from the Artificial Neural Network Technique

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***Abstract* - This study uses annual time series data on adolescent fertility rate for Angola from 1960 to 2020 to predict future trends of adolescent fertility rates over the period 2021 to 2030. The forecast evaluation criteria of the applied model indicate that the ANN (12, 12, 1) model is stable. The neural network model projections revealed that adolescent fertility will remain very high throughout the out of sample period. Therefore, we urge the Angolan government to allocate more resources towards Sexual and reproductive health services, strictly enforce laws that safeguard sexual and reproductive health rights of adolescent girls and women, promote girl child education and create a youth fund to empower youths across the country in order to urgently address high adolescent birth rates that have contributed significantly to adverse maternal and neonatal health outcomes.**

Keywords: ANN, Forecasting, adolescent fertility rate.

I. INTRODUCTION

The 1994 International conference on Population and development (ICPD)took place in Cairo, Egypt and its main thrust was to address sexual and reproductive health rights for both sexes and ensure universal access to health including sexual and reproductive health (UN, 1995). The conference focused on resolving gender imbalances or inequalities which are existing in the society with particular emphasis on recognizing the sexual and reproductive rights of adolescent girls and women. Respecting the rights of women is a priority at global level as this forms the basis of socioeconomic development. Girls and women should be accorded equal access to education, health and employment opportunities in order to improve the living standards of women and children. In September 2015, all 193 UN member states drafted the Agenda 2030 for sustainable development outcome document to push member states to take more drastic action in addressing teenage pregnancies that are driving high maternal and under five deaths especially in low and middle income countries (UN, 2020; WHO, 2019; UNICEF, 2019; UNICEF, 2018; UN, 2016; UN, 2015). The 3rd sustainable development goal target 3.7 focuses on addressing sexual and reproductive health issues including adolescent SRH issues. Ensuring access to affordable and quality client specific family planning services is a huge step towards achieving the set targets of the 3rd sustainable developments goal (SDGs) by 2030.Comprehensive Family planning services should consist of health information, education, counseling, screening of STIs, quality antenatal and post natal care, appropriate contraceptive methods, and upholding of human rights especially for adolescent girls and women. Literature for Angola has shown that the modern contraceptive prevalence rate stands at 12.8% with significant variations across regions (Yaya & Ghose, 2018).Total fertility rates in Angola have been decreasing over the past decades from 7.5 births per woman in 1975 to 5.6 births per woman in 2020 (Worldometer, 2020). The major drivers of fertility being adolescent births rates.

This paper applies a machine learning algorithm to predict future trends of adolescent fertility in Angola with the aim of determining the future magnitude of adolescent births in the country. This will guide policy makers in designing effective policies to address early child marriages, to allocate funds towards empowerment of youths and establishing adolescent friendly health facilities.

II. METHODOLOGY

The Artificial Neural Network (ANN) approach, which is flexible and capable of nonlinear modelling; will be applied in this study. The ANN is a data processing system consisting of a large number of highly interconnected processing elements in architecture inspired by the way biological nervous systems of the brain appear like. Since no explicit guidelines exist for the determination of the ANN structure, the study applies the popular ANN (12, 12, 1) model based on the hyperbolic tangent

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activation function. This paper applies the Artificial Neural Network (ANN) approach in predicting annual adolescent fertility rate for Angola.

Data Issues

This study is based on annual adolescent fertility rate in Angola for the period 1960– 2020. The out-of-sample forecast covers the period 2021 – 2030. All the data employed in this research paper was gathered from the World Bank online database.

III. FINDINGS OF THE STUDY

ANN Model Summary

Table 1: ANN model summary

Variable	R
Observations	49 (After adjusting Endpoints)
Neural Network Architecture:	
Input Layer Neurons	12
Hidden Layer Neurons	12
Output Layer Neurons	1
Activation Function	Hyperbolic Tangent Function
Back Propagation Learning	
Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.004974
MSE	0.421968
MAE	0.524820

Residual Analysis for the Applied Model

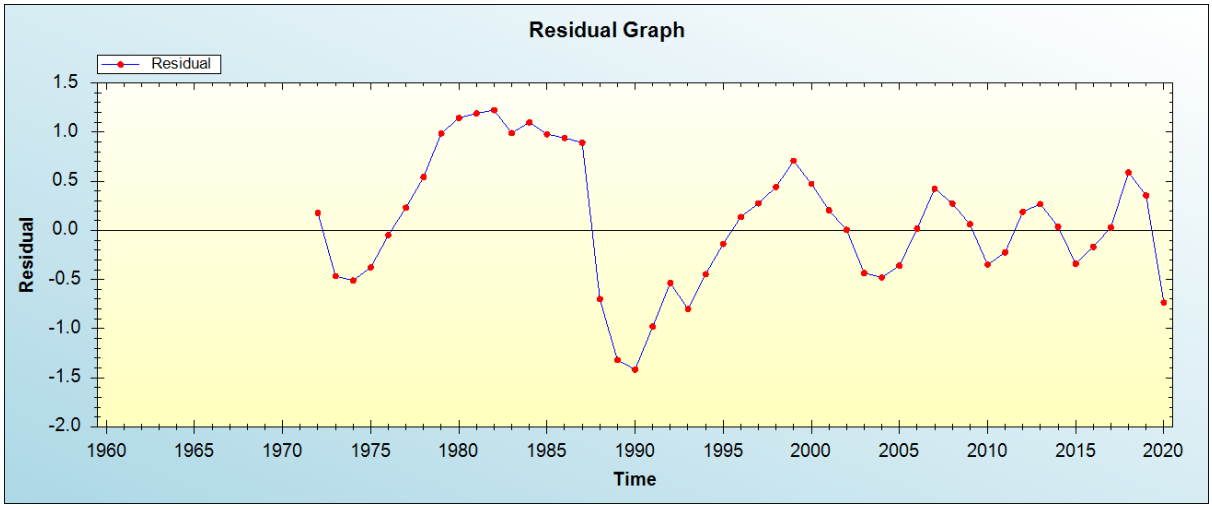

Figure 1: Residual analysis

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In-sample Forecast for R

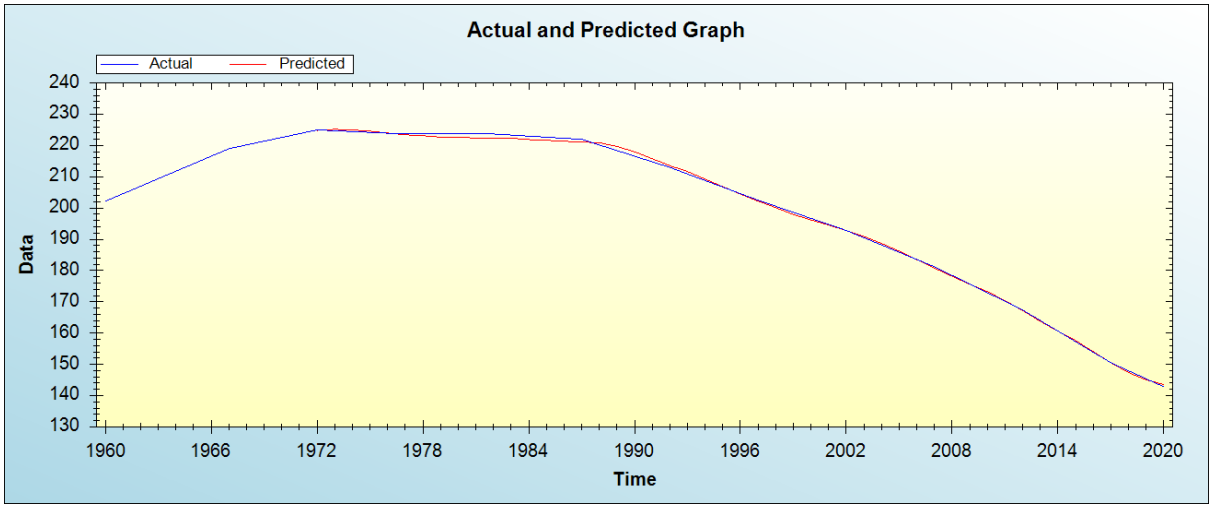

Figure 2: In-sample forecast for the R series

Out-of-Sample Forecast for R: Actual and Forecasted Graph

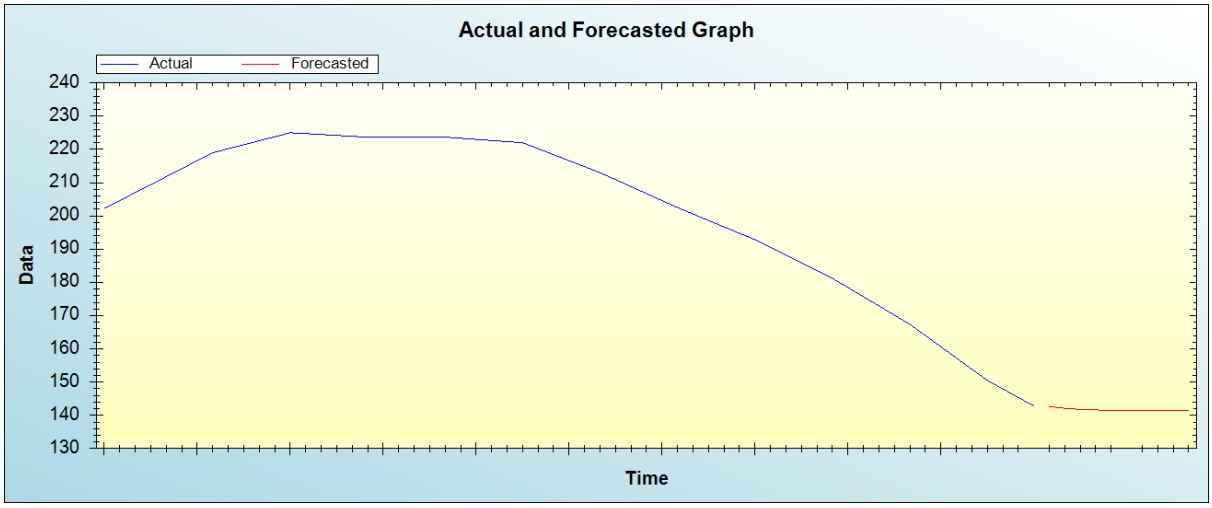

Figure 3: Out-of-sample forecast for R: actual and forecasted graph

Out-of-Sample Forecast for R: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Year	Predicted adolescent fertility rate
2021	142.6558
2022	142.1127
2023	141.8099
2024	141.6406
2025	141.5328
2026	141.4654
2027	141.4312
2028	141.4087
2029	141.3985
2030	141.3913

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The main results of the study are shown in table 1. It is clear that the model is stable as confirmed by evaluation criterion as well as the residual plot of the model shown in figure 1. It is projected that annual adolescent fertility will remain very high throughout the out of sample period.

IV. POLICY IMPLICATION & CONCLUSION

The modern contraceptive prevalence rate in Angola is estimated to be 12.8 percent with significant variations across regions. Total fertility rates in Angola have been steadily declining during the previous decades from 7.5 births per woman in 1975 to 5.6 births per woman in 2020. Adolescent births rates have been identified as the main driver of fertility in this country. During the period 1972-2020, adolescent fertility gradually declined from 225 births per 1000 women aged 15-19 years to 143 births per 1000 women aged 15-19 years. These figures indicate that adolescent births are very high in this country. This study applied a machine learning technique to forecast future trends of adolescent fertility for Angola. Our findings suggest that adolescent fertility will remain very high throughout the out of sample period. Therefore, we encourage the Angolan government to allocate more resources towards Sexual and reproductive health services, strictly enforce laws that safeguard sexual and reproductive health rights of adolescent girls and women, promote girl child education and create a youth fund to empower youths across the country in order to urgently address high adolescent birth rates that have contributed significantly to adverse maternal and neonatal health outcomes.

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